MONTHLY WEATHER REVIEW.

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INTRODUCTION.

This REVIEW contains a general summary of the meteorological conditions which prevailed over the United States and Canada during August, 1884, based upon the reports from the regular and voluntary observers of the Signal Service and co-operating state weather services.

Descriptions of the storms which occurred over the north Atlantic ocean during the month are also given and their approximate paths shown on chart i.

The following may be mentioned as the most noteworthy meteorological features of the month:

1st. The low mean temperatures which prevailed over the greater part of the country, the departures being greatest in the northern plateau and north Pacific coast region, and from Colorado and Wyoming eastward to the Mississippi river.

2d. The frosts which occurred in the upper lake region on the 9th; and in New England and the middle Atlantic states on the 25th, those occurring on the last mentioned date being destructive to vegetation.

3d. The excessive precipitation over the eastern Rocky mountain districts, upper Missouri valley, and extreme northwest; and the unusually small precipitation in the central valleys and Gulf states, where severe drought prevailed.

4th. The moderate weather which prevailed generally over the north Atlantic ocean, the depressions traced on chart i. being of slight energy. It is worthy of note that no tropical hurricane passed near the coasts of the United States during this month.

On the afternoon of the 10th an earthquake shock was felt along the Atlantic coast, and to a considerable distance inland, from Maryland and Delaware northward to Massachusetts and southern Vermont.

With this number of the REVIEW are published two additional charts, numbers iv. and v. The former shows the regions over which frosts occurred on the 9th and 25th, with the isotherms showing the minimum temperatures for the same dates; and the latter shows the departures from the normal atmospheric pressure and temperature.

On pages 197 and 206 will be found tables containing miscellaneous meteorological data from the regular and voluntary observers of the Signal Service.

In the preparation of this REVIEW the following data, received up to September 20th, 1884, have been used, viz.: the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and twenty-two Signal Service stations and eighteen Canadian stations, as telegraphed to this office; one hundred and fifty-eight monthly means from the former, and eighteen monthly means from the latter; two hundred and sixty-five monthly registers from voluntary observers; forty-five monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports, through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs, furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the local weather services of Alabama, Georgia, Indiana, Louisiana, Missouri, Nebraska, Ohio, and Tennessee, and of the Central Pacific railway company; trustworthy newspaper extracts; and special reports.

ATMOSPHERIC PRESSURE.

[*Expressed in inches and hundredths.*]

The mean atmospheric pressure for August, 1884, determined from the tri-daily telegraphic observations of the Signal Service, is exhibited by the isobarometric lines on chart ii. As in the previous months (since May) the area of least pressure includes the middle and southern plateau districts, where the monthly barometric means are slightly below 29.85. From the region above named the pressure increases to 30.0 on the north Pacific coast, and to 30.05 over an area extending from the lower Mississippi valley northeastward to Nova Scotia.

Compared with the mean pressure for July, 1884, a slight decrease is shown on the Pacific coast, the deficiency amounting less than .05, except at Portland, Oregon, where it is .07. Eastward of a line extending from Idaho southward to Arizona, except in southern Florida, the mean pressure is greater than for the preceding month. From the Rocky mountains eastward to the ninety-fifth meridian; and in the Gulf states the increase varies from .01 to .10. From the lower Missouri and lower Arkansas valleys northeastward to Nova Scotia, the increase varies from .10 to .25, being greatest over the last-named region, and in New England. It is worthy of remark that the marked increase of pressure over this region as compared with last month corresponds to a decided decrease of pressure in the same region for July as compared with that for June.

The mean pressure for August, 1884, compared with the normal (see chart v.) shows a deficiency ranging from .01 to .06 over the northern districts from the lower lakes westward to Montana. A slight deficiency also occurs in the north Pacific coast region, in the southern plateau, and in southern California; in all other districts the mean pressure is normal or slightly above.

BAROMETRIC RANGES.

The barometric ranges were greatest in the lake region and extreme northwest, where they exceeded .75; they were least in Arizona, southern California, along the west Gulf coast, and in southern Florida, where they were less than .25. The smallest monthly range, .22, occurred at Fort Grant, Arizona; and the greatest, .82, occurred at Alpena, Michigan.

In the several districts the monthly ranges varied as follows:

New England.—From .48 on the summit of Mount Washington, New Hampshire, and .52 at Eastport, Maine, to .63 at Boston, Massachusetts.

Middle Atlantic states.—From .52 at Lynchburg and Norfolk, Virginia, to .68 at Albany, New York.

South Atlantic states.—From .34 at Jacksonville, Florida, to .55 at Kitty Hawk, North Carolina.

Florida peninsula.—From .24 at Key West to .34 at Cedar Keys.

East Gulf states.—From .31 at New Orleans, Louisiana, to .37 at Montgomery, Alabama.

West Gulf states.—From .25 at Galveston and Indianola, Texas, to .41 at Little Rock, Arkansas.

Rio Grande valley.—From .21 at Brownsville, Texas, to .25 at Rio Grande City, Texas.

Tennessee.—From .38 at Chattanooga and Knoxville, to .45 at Nashville.

Ohio valley.—From .56 at Louisville, Kentucky, to .59 at Cincinnati, Ohio.

Lower lake region.—From .61 at Cleveland, Ohio, to .76 at Rochester and Oswego, New York.

Upper lake region.—From .68 at Chicago, Illinois, to .82 at Alpena, Michigan.

Extreme northwest.—From .61 at Fort Buford, Dakota, to .75 at Moorhead, Minnesota.

Upper Mississippi valley.—From .48 at Cairo, Illinois, to .69 at La Crosse, Wisconsin.

Missouri valley.—From .62 at Leavenworth, Kansas, to .74 at Huron, Dakota.

Northern slope.—From .44 at Helena, Montana, to .61 at North Platte, Nebraska.

Middle slope.—From .45 on the summit of Pike's Peak, Colorado, to .56 at West Las Animas, Colorado.

Southern slope.—From .27 at Fort Stockton, Texas, to .42 at Fort Sill, Indian Territory.

Southern plateau.—From .22 at Fort Grant, Arizona, to .36 at El Paso, Texas.

Middle plateau.—.47 at Salt Lake City, Utah.

Northern plateau.—From .42 at Dayton, Washington Territory, to .54 at Lewiston, Idaho.

North Pacific coast region.—From .42 at Fort Canby, Washington, Territory, to .44 at Portland, Oregon, and Olympia, Washington Territory.

Middle Pacific coast region.—From .30 at San Francisco, California, to .41 at Red Bluff, California.

South Pacific coast region.—.24 at Los Angeles and San Diego, California.

AREAS OF HIGH BAROMETER.

Only four areas of barometric maxima have been of sufficient importance to merit description, and of these, two only, numbers ii. and iii., caused marked changes in the weather conditions. Frosts occurred in Michigan and northern Ohio and Indiana during the passage of the former, and during the prevalence of the last-mentioned area, they occurred in the New England states and as far south as New Jersey. The high areas moved from the northwest to the central valleys and then eastward or northeastward to the Atlantic.

I.—The midnight chart of the 1st showed a barometric rise in Montana which continued about stationary above the normal until the morning of the 2d. On the afternoon of the 2d it had extended its influence southerly, continuing central in northern Montana, with barometric readings .20 above the normal, which departure continued with a southeasterly movement, and, on the afternoon of the 4th, it was central near Omaha, Nebraska. The area of departure of .20 from the normal had contracted and by the midnight report a uniform area, about .10 above the normal, spread from Missouri to Texas and northward to Dakota. Henceforward no distinct area of departure was observed, and nearly normal pressure existed, with light variable winds from Texas to the middle Atlantic states. The movement of this high area lowered the temperatures below the normal in the central valleys and the northwest. Local rains were abundant in all the districts, and temperatures below the normal accompanied the barometric area.

II.—This area was first observed on the morning of the 7th, in Manitoba, where the departure from the normal amounted to .20; the next morning it was central over Wisconsin. The temperatures accompanying the area were quite low for the season, frosts being reported in Michigan on the morning of the 8th. By the morning of the 9th, the high area overlaid the lake districts, the Saint Lawrence valley, and the states of Wisconsin, Illinois, and Iowa. Frosts were again reported in Michigan and on the northern Ohio and Indiana boundary. By the morning of the 10th, the high area had spread over New England and continued highest over the states of Illinois, Missouri, and Iowa. The temperatures accompanying this area were about 10° below the normal. By the morning of the 11th the pressure had diminished and was only slightly above the normal over the state of Missouri. Henceforth it deserves no mention, except that its eastern portion developed over the New England states and Canadian maritime provinces on the 12th, and, with the occurrence of a slight depression on the coast, noticed on the morning of the 13th, caused high northeasterly winds from North Carolina northward, and, by the 14th had moved into the Atlantic, but was immediately followed by a pressure above the normal from the Gulf to Canada. This high area continued hovering on the Atlantic and Gulf coasts till the 21st. After the 15th the winds, becoming southerly in the western portion of the high area, raised the temperatures above the normal which, for the first half of the month, had been generally below the normal.

III.—This high area appeared in northern Montana on the 22d, at the morning report of that date the barometer ranging from 30.1 to 30.16, or about .20 above the normal. At midnight of the 22d, the area extended, as a ridge of high pressure, from the Northwest Territories and Manitoba southeastward to Nebraska, and the temperature fell about 10° at stations in the extreme northwest and the Missouri valley. The high area moved southeastward and at the morning report of the 23d its centre was in Iowa, the barometer at Des Moines reading 30.2. The area continued its southerly movement until midnight of the 23d, when the centre was in Missouri; by the morning of the 24th the high area covered the Mississippi valley, the lake region, Tennessee and the Ohio valley, and the northern part of the west Gulf states, the region of greatest pressure being in the upper lake district, where the barometer read 30.2. In the districts named above the pressure ranged from .10 to .20 above the normal, except in Tennessee and the northern part of the west Gulf states, where the excess varied from .02 to .09; the temperature fell about 10° at stations in the northern part of the lake region, and about 5° elsewhere, with fair or clear weather in all districts. During the 24th the area moved east-southeastward, attended by increasing pressure and cool, clear weather; at the midnight report of that date the highest readings were observed at stations in Ontario and New York, where they varied from 30.21 at Saugeen, Ontario, to 30.30 at Albany, New York, or .22 and .26 above the normal respectively. Throughout the lower lake region, the northern half of the middle Atlantic states and the New England states, except Maine, the pressure exceeded 30.2. By the morning of the 25th, the isobar for 30.3 occupied eastern Pennsylvania, parts of Delaware and Maryland, New Jersey, and all the New England states except Maine; and during the night of the 24–25th, frosts occurred as far south as northern New Jersey and northeastern Pennsylvania. During the day the high area passed into the Atlantic and when last observed, on the morning of the 26th, it was near Nova Scotia and Cape Breton Island, where the barometer at Sidney read 30.35, or .37 above the normal. The minimum temperatures of the month in New England, the northern part of the middle states and at stations on Lake Ontario were associated with the passage of this high area, and more or less damaging frosts, which are fully enumerated under the head of "Frost," occurred in connection therewith.

IV.—This area appeared on the Pacific coast and at no time during its passage was it well defined. The morning report of the 28th, showed the pressure on the Pacific coast to be about

.10 above the normal; this condition prevailed during the day, the increase gradually spreading eastward. By the morning of the 29th, the area of highest pressure occupied Montana and Idaho, where the barometric readings varied from 30.12 to 30.24, or about .20 above normal. The pressure increased slowly during the day in a southerly and southeasterly direction, and by the 30th the barometer was highest in Kansas, where it read 30.11. During the day the pressure decreased until it reached the normal condition and the high area disappeared without exhibiting any marked meteorological features.

AREAS OF LOW BAROMETER.

On referring to chart i. it will be seen that the greater part of the low areas traced during the month have moved eastward at comparatively high latitudes (north of N. 48°), skirting only the northern boundary of the United States, with the exception of low areas x. and xi., which developed in Ohio and in Michigan on the 28th and 29th. No storm-centres are traced in the eastern half of the United States south of the Saint Lawrence valley or the lake region. In addition to the two distinct storm-centres traced in the western part of the United States, an extensive area of low pressures has remained in the plateau regions throughout the entire month. The general direction of movement of the low areas was south of east until reaching the Lake Superior region, and thence east or north of east to the Saint Lawrence valley. Only slight storm energy was exhibited during the passage of the centres.

The following table gives the latitude and longitude in which each area was first and last observed, and the average hourly velocity:

Areas of low barometer.	First observed.		Last observed.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
	° ′	° ′	° ′	° ′	
No. I	50 00	109 00	47 00	75 00	21.8
II	48 00	90 00	47 00	78 00	29.2
III	52 00	105 00	52 00	95 00	25.0
IV	45 00	109 00	48 00	97 00	18.8
V	49 00	69 00	49 00	63 00	32.5
VI	38 00	103 00	51 00	64 00	40.2
VII	49 00	100 00	51 00	62 00	35.7
VIII	52 00	113 00	50 00	60 00	33.8
IX	50 00	100 00	47 00	74 00	50.0
X	41 00	84 00	47 00	74 00	22.0
XI	44 00	84 00	50 00	67 00	29.0
Mean hourly velocity					30.7

* Centres united in about N. 46°, W. 76°. The average hourly velocity of low centres for August, as determined for 1876 and 1884, inclusive, is 24.4 miles.

I.—At the morning report of the 1st the pressure over Montana and Dakota was from .20 to .40 below the normal, the centre of disturbance being in British America, north of Montana, where the barometer at Medicine Hat read 29.48. Signals were ordered at Duluth in the morning, and in the afternoon on Lakes Michigan, Superior and Huron, as far as Alpena. The area moved in an east-southeasterly direction with slight change of pressure at the centre, and on the morning of the 2d it reached Minnesota, the barometer at Saint Vincent reading 29.52, or .40 below the normal. Cloudy weather, local storms, and thunder storms occurred in Minnesota, Dakota, Wisconsin, and Iowa, and heavy rain was reported from stations lying north of the centre, and a tornado occurred in Wisconsin. On the 3d the depression passed over Lake Superior, causing cloudy or rainy weather in the Mississippi and Ohio valleys and in the lake region; in those districts the pressure was from .10 to .30 below the normal, with temperature slightly above normal. Cautionary signals were ordered at all stations on Lake Huron in the morning of this date, and at stations on Lakes Erie and Ontario in the afternoon. On the morning of the 4th the disturbance, having passed eastward over Ontario, was central in the province of Quebec, the lowest reported pressure being 29.66 at Rockliffe, Ontario; during the 4th the depression disappeared with rising pressure. Brisk to high winds occurred at stations in the lower lake region during the passage of this disturbance. All signals were lowered at the morning report of the 4th, with justification velocities on the upper lakes.

II.—This area appeared north of Lake Superior at midnight of the 5th, when the barometer at Prince Arthur's Landing read 29.64; it moved southeastward, attended by rainy weather at stations in the vicinity of the centre, and brisk to high winds at stations in Minnesota, Wisconsin, and Michigan. Cautionary signals were displayed on the morning of the 6th at Escanaba, the Lake Superior stations, and the Straits of Mackinaw; the signals were late at Duluth, and a gale occurred at Milwaukee without signals. At the afternoon report of the 6th the signals were lowered. By the morning of the 7th the depression had passed into Canada, where it apparently filled up. On the 7th gales occurred on the middle Atlantic coast, for which signals were ordered, in the afternoon, from Point Judith to Fort Macon, but were late from the capes of Delaware to the capes of Virginia. A gale also occurred at Sandusky, Ohio. On the morning of the 8th, signals were lowered, having been justified by velocities of at least twenty-five miles, as far south as Kitty Hawk.

III.—This disturbance, which was at no time within the limits of the United States, appeared in the Saskatchewan valley on the afternoon of the 11th; it moved eastward, causing a slight decrease of pressure at stations on the northern boundary of the United States, and disappeared beyond the field of observation on the 12th.

IV.—This depression appeared in southern Montana on the morning of the 14th, the pressure near the centre being below 29.80, or about .10 below the normal. At the afternoon report of the same day, the region of least pressure remained in Montana, and the area of decreasing pressure had extended to the northward and eastward. At the midnight report the lowest barometer reading was observed at Qu' Appelle, 29.59; at northern stations in Montana and Dakota the pressure was .20 below the normal. During the 15th the disturbance passed southeastward to Minnesota where it dissipated. Light showers occurred at stations in Montana and Dakota, and thunder-storms were reported from the region north of those territories during the passage of this area. The maximum temperatures of the month in Montana and Dakota also occurred in connection therewith.

V.—This was a slight disturbance which appeared north of Father Point, Quebec, at the midnight report of the 17th, when the barometer at that station read 29.77 or .15 below the normal. On the 18th the low area moved to the Gulf of Saint Lawrence.

VI.—This disturbance developed in Colorado during the 18th, and by the afternoon report of the 19th the atmospheric depression had extended northward and eastward over Nebraska and Kansas, although the minimum pressure, 29.50, was reported from West Las Animas, Colorado, where the barometer stood .30 below the normal. At the midnight report of the 19th the centre of disturbance was in Dakota, the barometer at Huron reading 29.50, or .44 below the normal, and at Moorhead, Minnesota, it read 29.52, or .42 below the normal. Gales occurred on Lake Michigan on the 19th, and signals were ordered at the midnight report on Lake Superior and northern ports of Lake Michigan. During the 20th the depression moved north-northeastward over Minnesota, accompanied by cloudy weather and light rains in that state, and at stations in the Mississippi valley and the upper lake region; brisk to high southwest winds occurred in the last-mentioned districts, with a gale at Milwaukee, but signals were not justified except at Duluth, during the passage of the disturbance. On the morning of the 21st the disturbance appeared as an extended depression central north of the lake region, the pressure in that district and along the Saint Lawrence valley being from .10 to .20 below the normal. When last observed at midnight of the 21st the depression was apparently over the Gulf of Saint Lawrence, the lowest recorded barometer being 29.69 at Father Point, Quebec, and 29.67 at Anticosti, or about .23

below the normal; brisk to high southwest winds were reported at Sidney, Cape Breton Island, and at Bird Rock. The maximum temperatures of the month, in the Mississippi valley and at stations in the northern part of the upper lake region, occurred in connection with the passage of this area.

VII.—This was a slight disturbance which appeared in Manitoba on the 22d; it moved east-southeastward during the day, and at the morning report of the 23d, the lowest recorded barometer readings were 29.81 at Mackinaw City, Michigan, and 29.83 at Parry Sound, Ontario, these values being .22 and .20 below the normal, respectively. By the afternoon report of the 23d, the pressure had decreased to 29.70 at Rockliffe, Ontario, and high winds to gales occurred in the lower lake region, with light to heavy rains at the northern stations. The disturbance moved down the Saint Lawrence valley, and as the winds shifted to northwest and west in the lower lake region, they attained a velocity ranging from twenty-five to thirty-three miles an hour at stations on Lakes Huron, Erie, and Ontario. On the morning of the 24th the disturbance reached the mouth of the Saint Lawrence, and passed over the Gulf.

VIII.—The afternoon reports of the 23d showed a considerable decrease of pressure in the region north of Montana; at the midnight report the barometer at Medicine Hat read 29.37, while the pressure in northern Montana and northwestern Dakota was more than .20 below the normal. On the morning of the 24th the lowest barometer readings were reported from northern Dakota and the Saskatchewan valley, where the pressure was 29.52 to 29.62, or about .30 below the normal. The low area moved eastward north of the United States, and on the 25th it occupied the Lake Superior region; it then moved in a course slightly south of east over the northern part of the lake region, giving rainy weather in both the upper and lower lake regions, with high south and southwest winds to gales in the former and brisk to high winds in the latter district. The pressure increased as the disturbance moved along the Saint Lawrence valley during the 26th causing showery weather in that district. By the morning of the 27th the depression had passed to the northward of Anticosti Island.

IX.—This area appeared in the Saskatchewan valley on the 28th, with a subsidiary depression in Minnesota. During the day the principal depression moved east-southeastward, and was over Lake Superior on the morning of the 29th, the pressure at Duluth, Minnesota, being 29.60, or .42 below normal; at the afternoon report the centre of this depression was in western Ontario, while another disturbance, which had moved up from the Ohio valley, was central over Lake Huron. During the day the two disturbances probably united and, together with low area xi., passed as an extensive depression along the Saint Lawrence valley at the close of the month.

X.—This disturbance apparently developed in the Ohio valley on the 28th; at the afternoon report of that date the barometer at Columbus, Ohio, had fallen to 29.70, or .30 below normal, and light rain had been falling at stations in the Ohio valley and in the southern part of the lower lake region since the morning report. At midnight the minimum pressure was reported from Port Huron, where the barometer read 29.59, or .41 below the normal; rainy weather continued at the lake stations, and at Buffalo the wind reached a velocity of twenty-six miles an hour from southeast. On the morning of the 29th the storm-centre was near Toronto, Ontario; at that station the barometer read 29.55, or .48 below normal; rain continued to fall at stations near the centre, and cloudy weather with occasional rains prevailed in the middle Atlantic states. At the afternoon report of the 29th the depression still occupied Ontario, the pressure at stations in that province ranging from 29.54 to 29.60. Brisk to high southwest winds occurred at stations on Lake Ontario, and the rain area extended to New England. At midnight the disturbance was passing northeastward over the Saint Lawrence valley, causing rainy weather in that district, while a secondary depression had appeared over Lake Huron. Severe local storms occurred in Illinois, Indiana, and northern Kentucky during the passage of this disturbance.

XI.—This disturbance, which was probably a secondary development of low areas ix. and x., appeared over Lake Huron, at midnight of the 29th; at that report the barometer at Port Huron read 29.59, or .41 below the normal. On the morning of the 30th, the storm-centre was apparently over the northern part of the lake, the minimum pressures being 29.53 at Alpena, Michigan, and 29.55 at Saugeen, Ontario, or about .45 below the normal. At the afternoon report of the 30th, the barometer at Rockliffe, Ontario, read 29.46, or .49 below normal; high westerly winds to gales prevailed at stations on Lakes Huron, Erie, and Ontario, with rainy weather at the northern stations. During the 31st the disturbance moved northeastward causing light rains in New England and along the Saint Lawrence valley, and followed by clearing weather in the lake region.

NORTH ATLANTIC STORMS DURING AUGUST, 1884.

[*Pressure expressed in inches and in millimetres; wind-force by scale of 0—10*

The paths of the atmospheric depressions that have appeared in the north Atlantic ocean during the month have been approximately determined from reports of observations furnished by agents and captains of ocean steamships and sailing vessels, and from other miscellaneous data received at this office up to September 20, 1884.

The observations used are in general simultaneous, being taken each day at 7 a. m. Washington, or 12h. 8m. p. m. Greenwich, mean time.

The month of August has been marked by an absence of severe storms; at the present writing no reports of vessels having encountered tropical or sub-tropical hurricanes during this month have been received at this office.

The paths of ten depressions are shown on the chart; of these, only one (number 10) has been traced as a continuation of a disturbance which first passed over the North American continent. The remaining depressions, which were ill-defined and unimportant, appear to have developed, for the most part, to the northeastward of the banks of Newfoundland, and have moved northeastward, manifesting little or no storm-energy during their passage.

The disturbances which reached the Gulf of Saint Lawrence from the westward have apparently moved northward beyond the region covered by the reports. This movement appears extremely probable in view of the fact that the depressions which passed over the continent moved to the northward of the usual tracks for August.

The weather over the north Atlantic ocean during the month may be summarized as follows: 1st to 18th, moderate to strong westerly breezes, attaining occasionally the force of a moderate gale; frequent fogs to the westward of W. 45°, weather variable. From the 18th to the close of the month, fresh to strong breezes with occasional gales, winds mostly from sw. to nw. and n.; generally cloudy or rainy weather. In connection with the subject of fog, Captain G. de Kersabiec, commanding the s. s. "Canada," (General Trans-Atlantic Co.), reports as follows: "We had much fog from longitude 35° west of Greenwich to longitude 53° W; sea generally high from Havre to the Banks."

The following are brief descriptions of the depressions charted:

1.—This is a continuation of the depression traced over the Atlantic as number 5 on the chart for July. At the close of that month the disturbance was central near N. 50°, W. 30°, and by August 1st, it had reached N. 51°, W. 20°, the pressure near the centre being below 29.6 (751.8); moderate to fresh nw. gales were reported by vessels on the fiftieth parallel and the westward of 20° W. During the day the depression moved northeastward near the British coasts, causing strong southerly winds and rain over the western districts of the British Isles.